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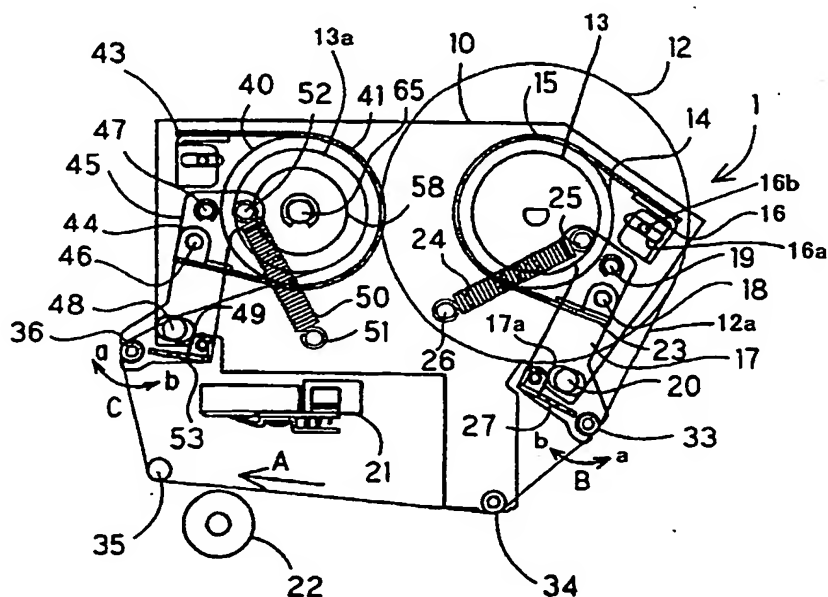
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(54) Abstract Title

Mechanism for adjusting tension of an inked ribbon of a printer

(57) A ribbon winding side ribbon holder [13a] and a ribbon supply side ribbon holder [13] are provided for supplying an inked ribbon [12] to a thermal printer [1]. A ribbon tension detecting plate [17] is rotatably supported on a frame [10] so as to be rotated in dependency on tension of the inked ribbon [12]. A ribbon tension adjusting means [15] is provided to be responsive to angular position of the ribbon tension detecting plate [17] for applying a load on the ribbon holder [13] so that the tension of the inked ribbon [12] is adjusted.

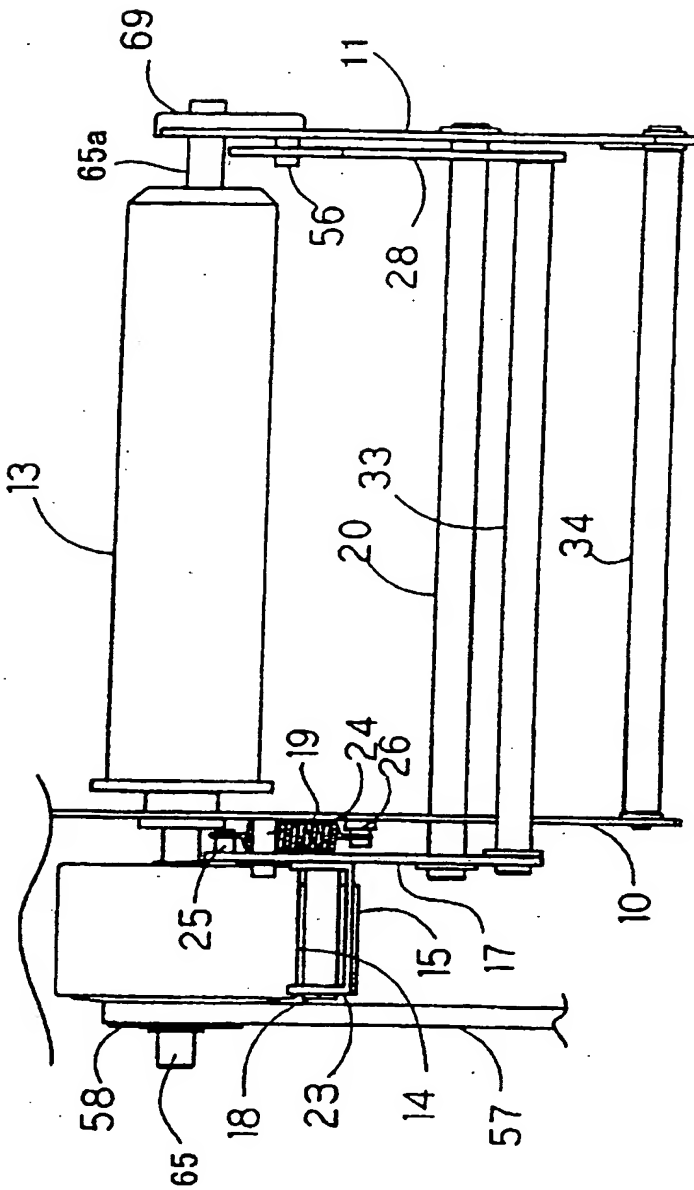
FIG. 1



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FIG. 2



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FIG. 3

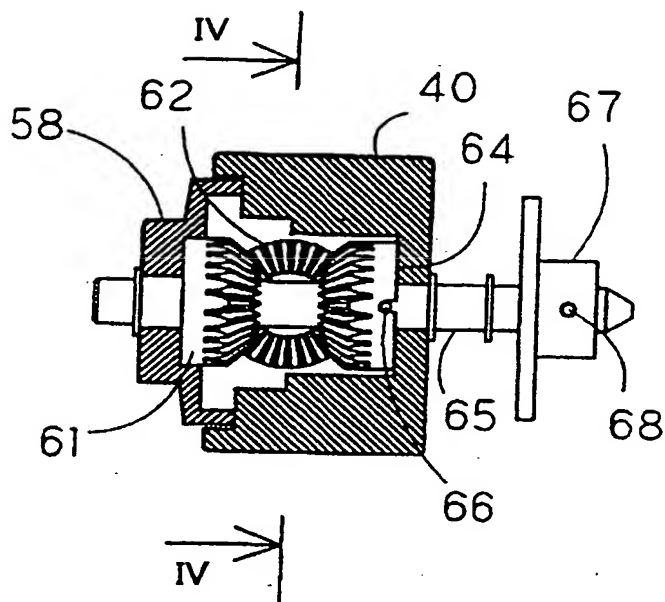
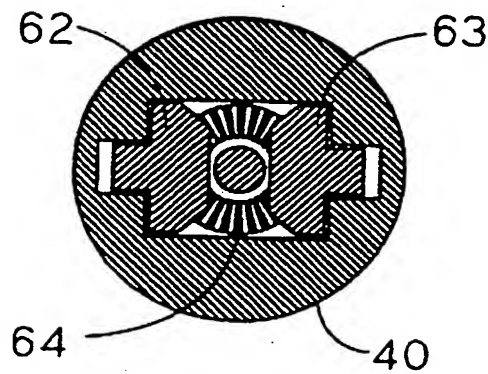
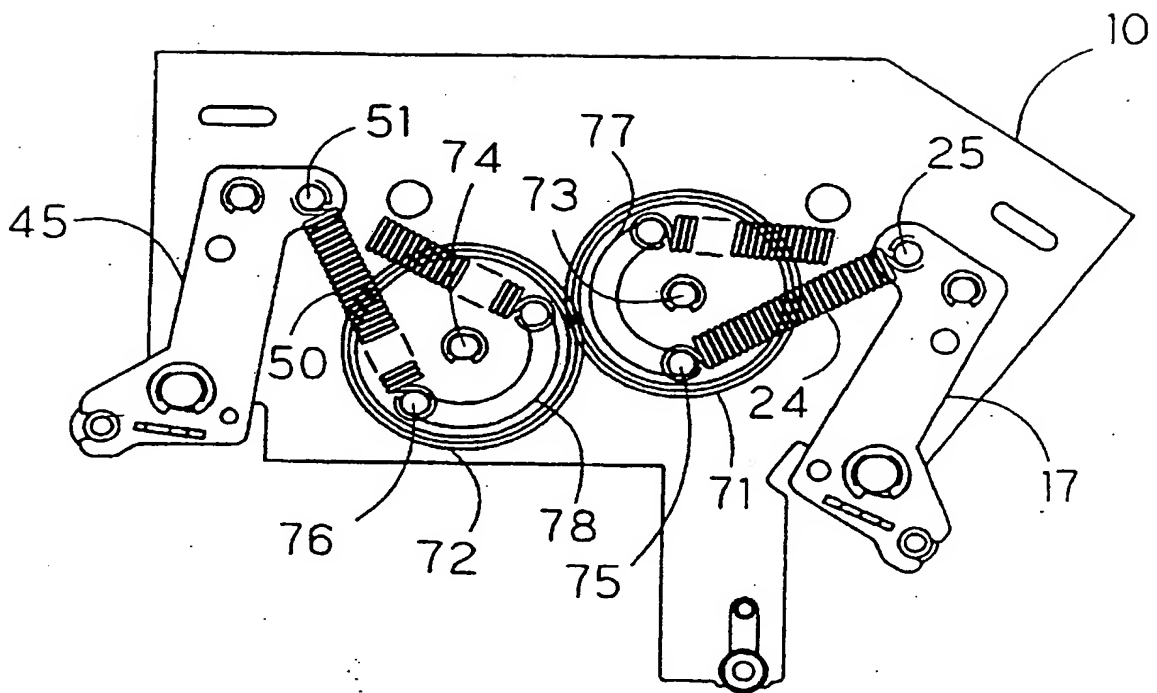


FIG. 4



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FIG. 5



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FIG. 6a

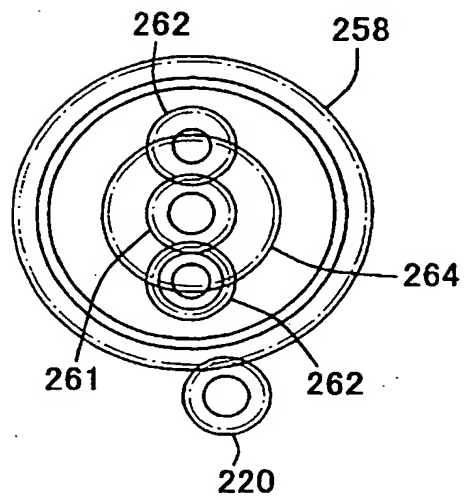
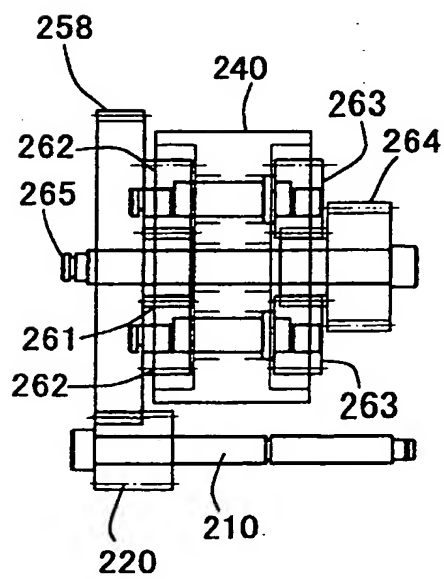
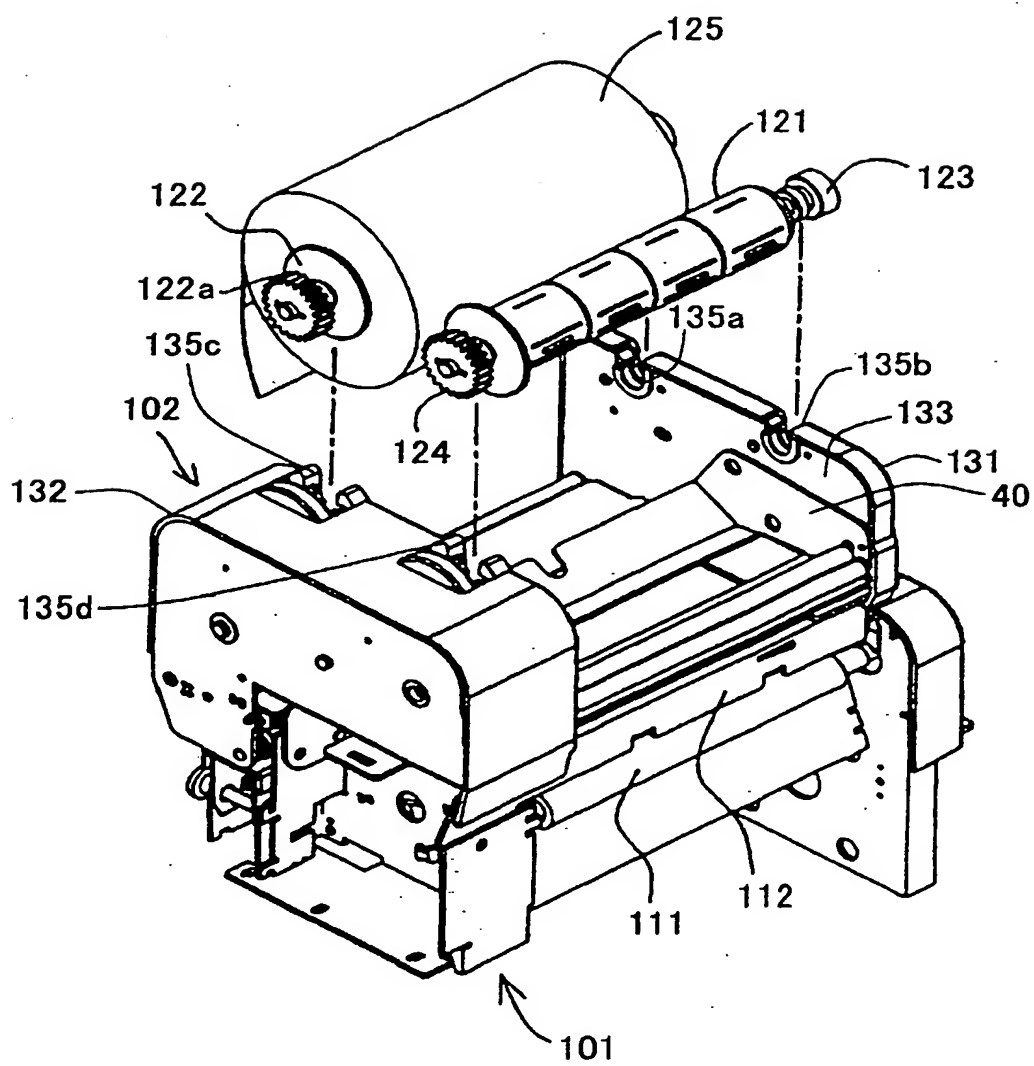


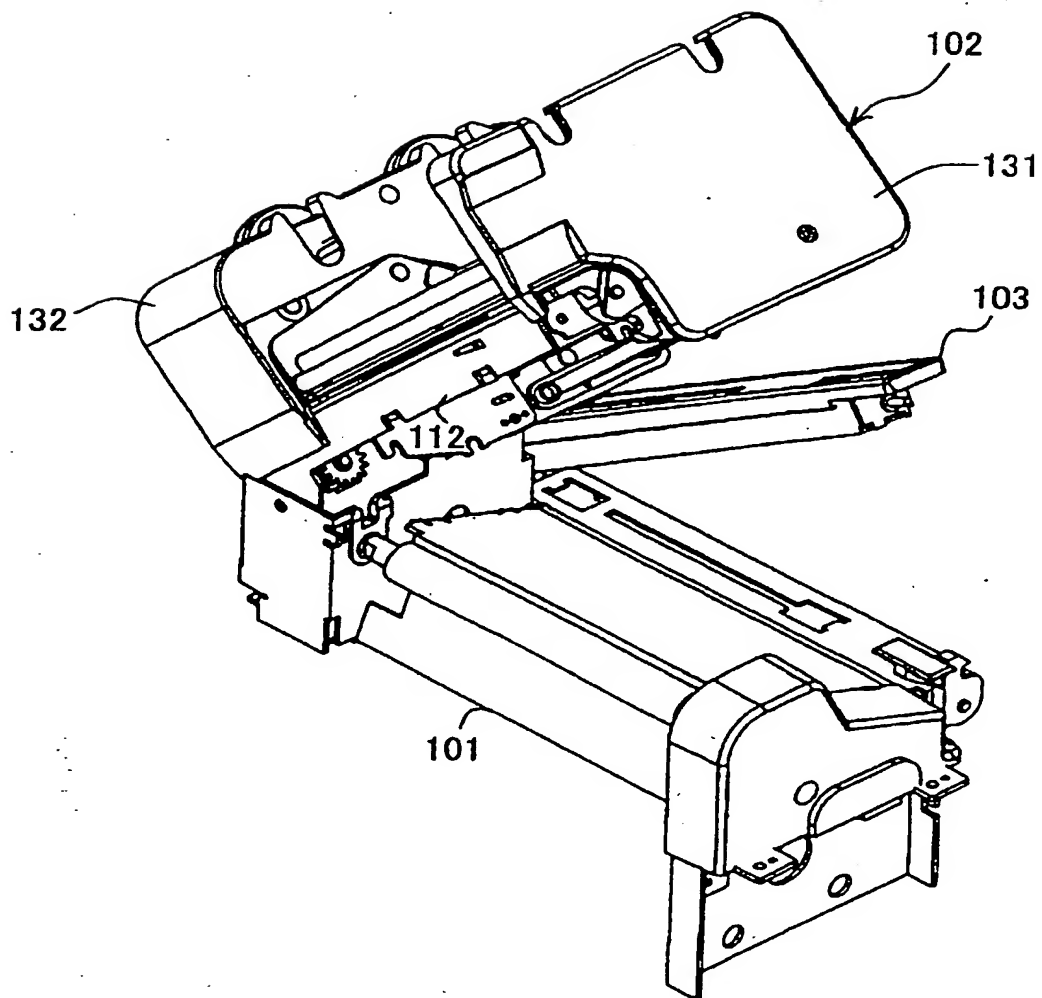
FIG. 6b



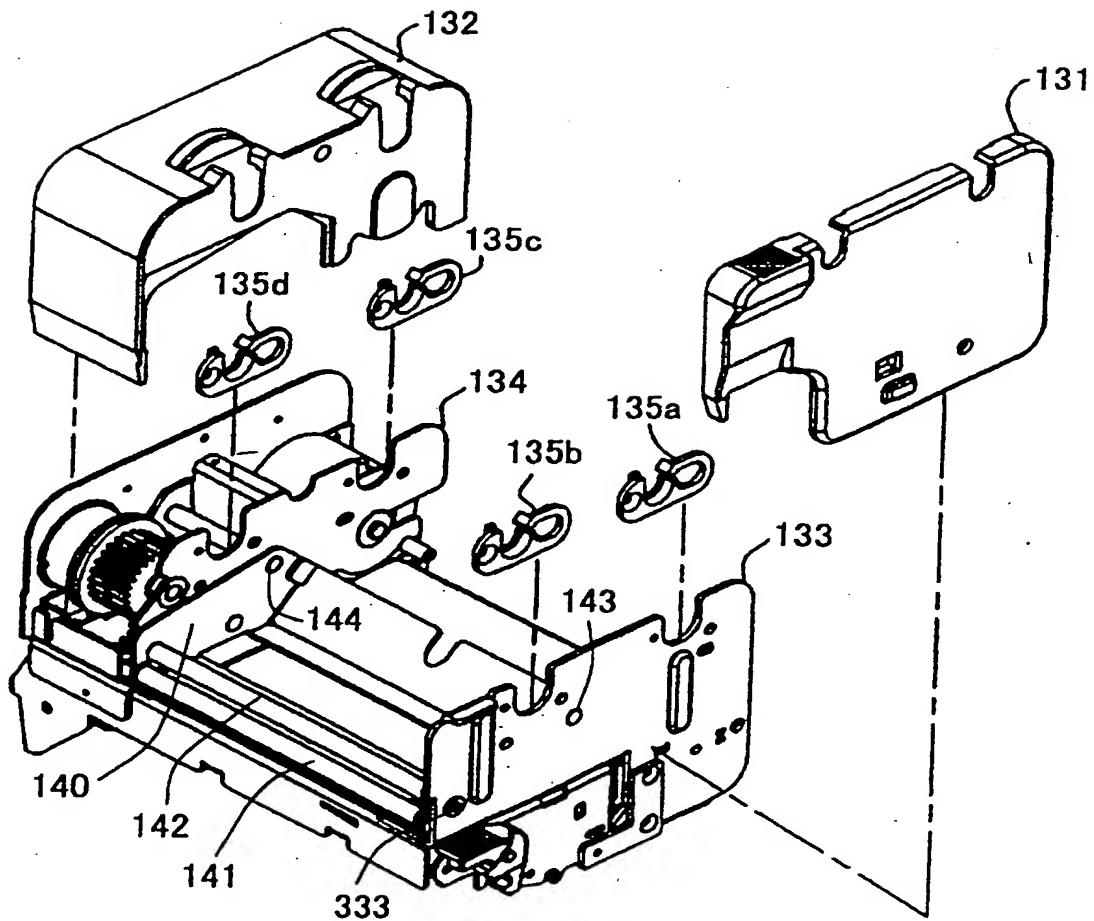
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FIG. 7



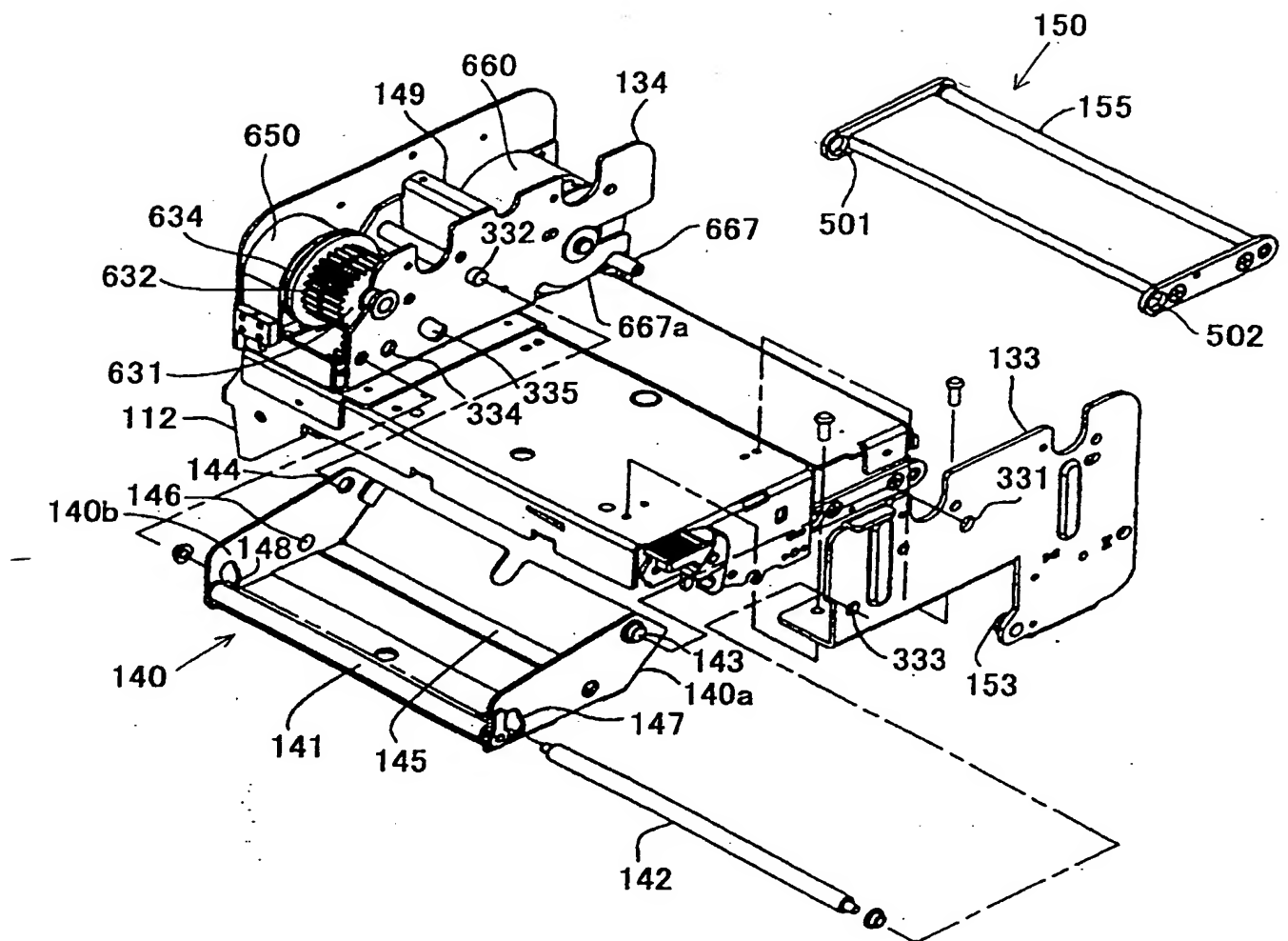
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FIG. 8



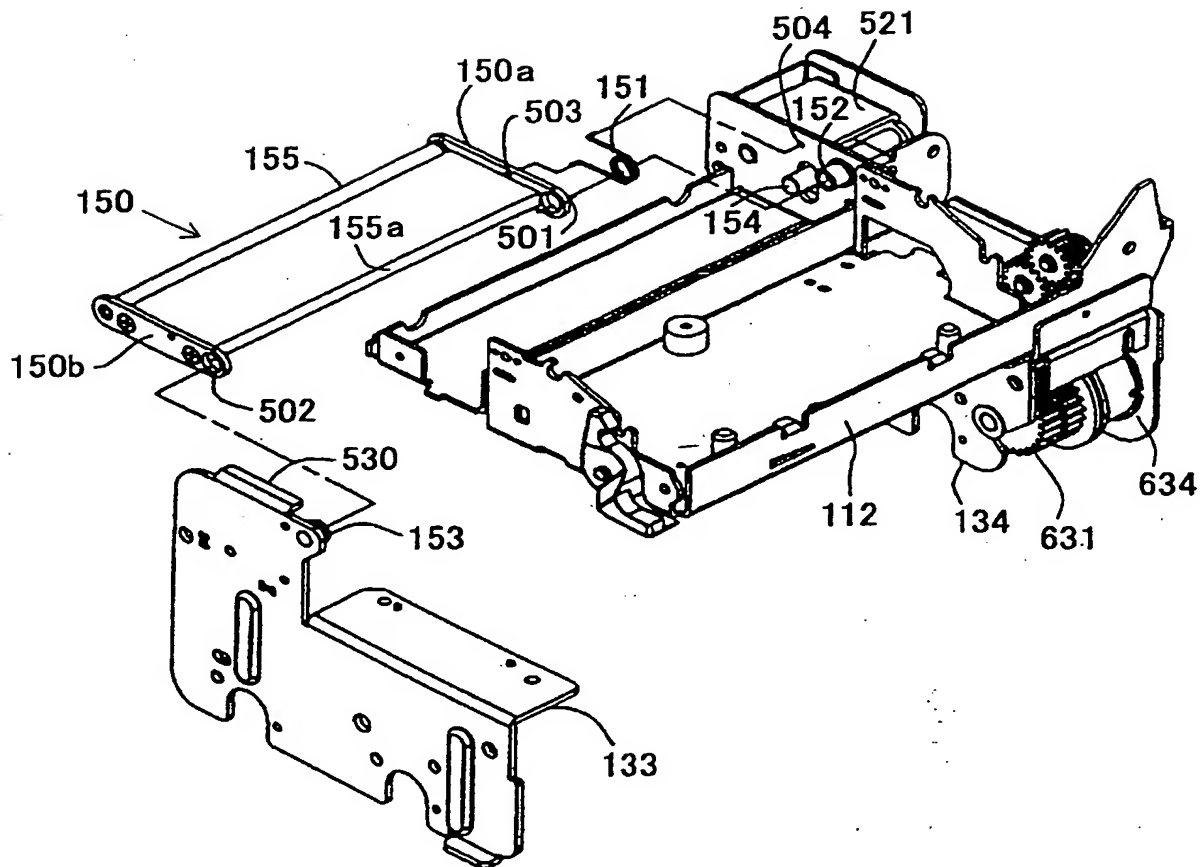
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FIG. 9



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FIG. 10

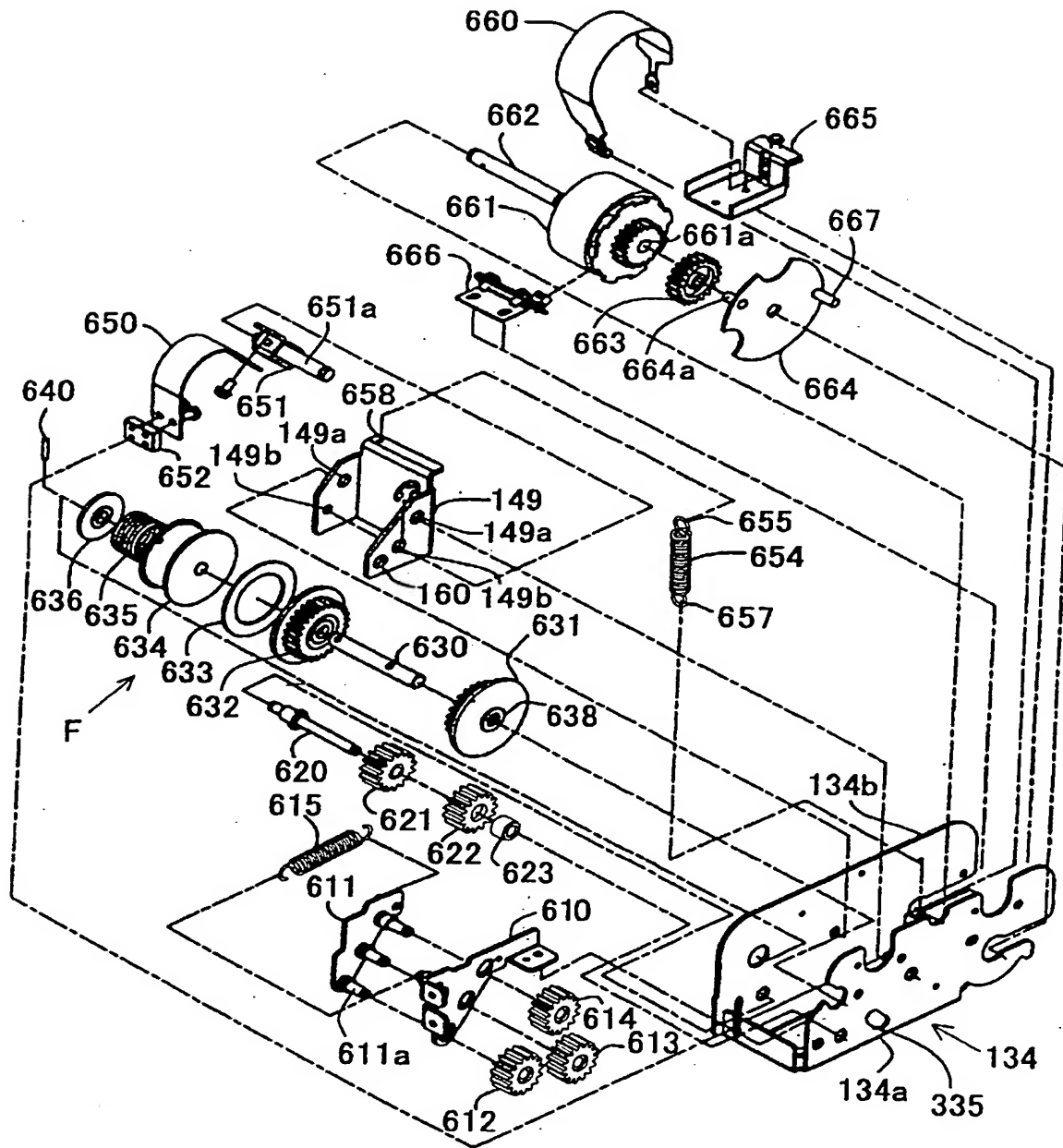


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FIG. 11



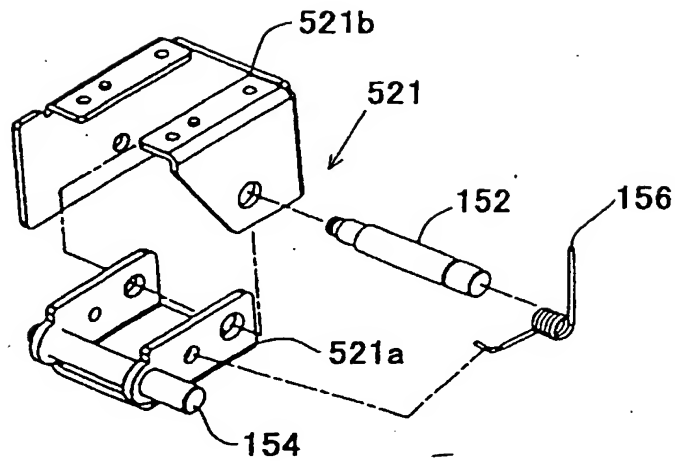
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FIG. 12a



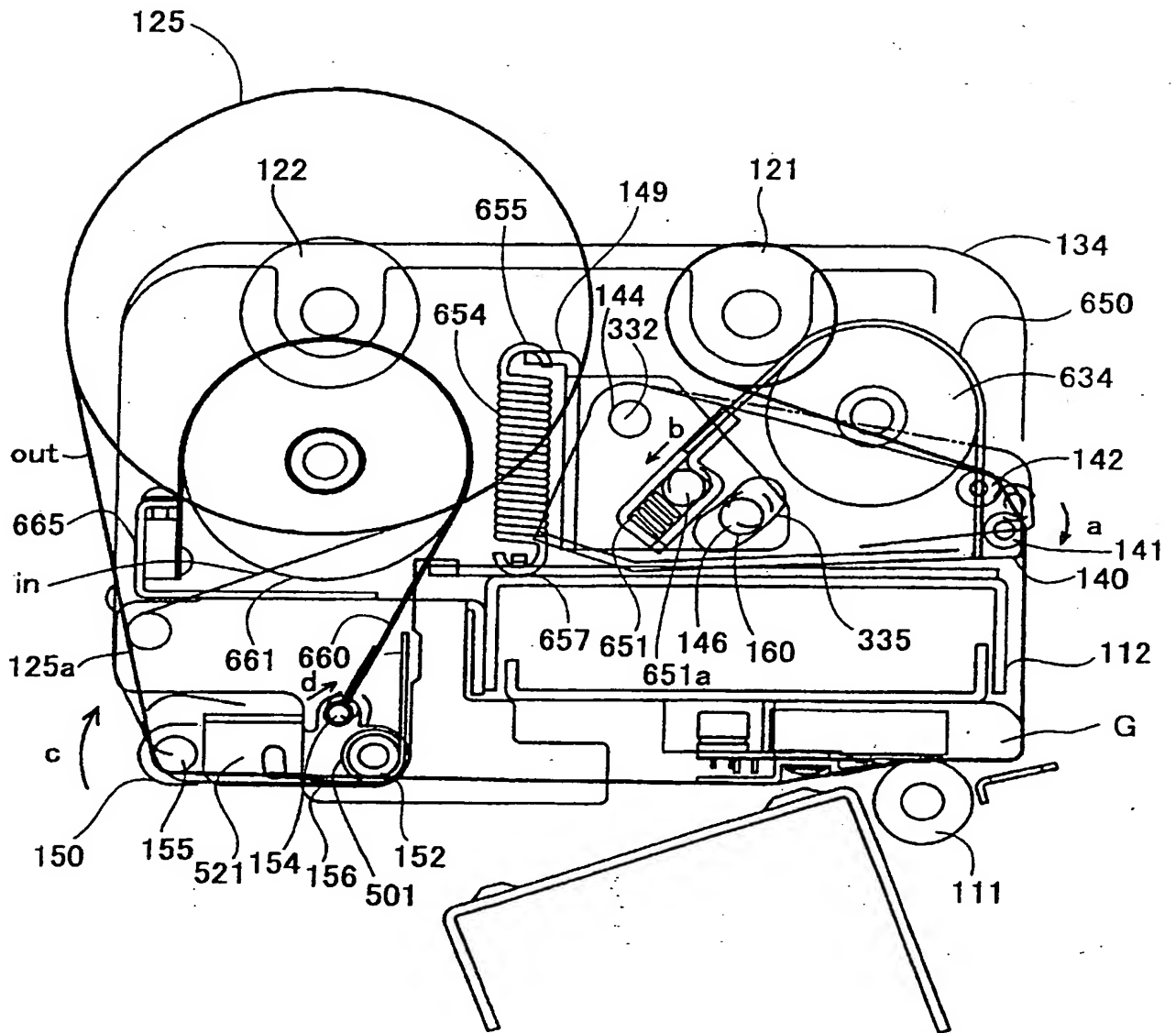
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FIG. 12b

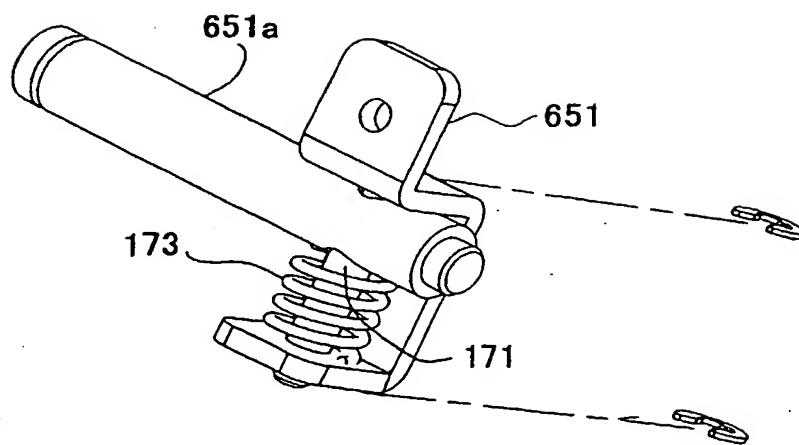


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FIG. 13



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FIG. 14



TITLE OF THE INVENTION

MECHANISM FOR ADJUSTING TENSION OF AN INKED RIBBON
OF A PRINTER

5 BACKGROUND OF THE INVENTION

The present invention relates to a mechanism for adjusting tension of an inked ribbon of a printer.

The thermal printer which produces printed impressions by using an inked ribbon is well known.

10 There are two tension applying mechanisms, one of which is provided for applying a back tension to a feeding ribbon, and the other is provided for applying a winding-up tension. The value of the tension applied to the ribbon has influence on the quality of the printing.

15 When the tension is too low, the ribbon wrinkles, causing printer failures in dots.

If the tension is too high, the ribbon slips and can not be fed.

20 Japanese Patent Application Laid Open 7-89172 discloses a mechanism for controlling tension applied to an inked ribbon to a constant value by detecting the fluctuation of the tension of the inked ribbon which is caused by the change of diameter of the rolled ribbon during the printing operation.

25 In the conventional system, there must be provided a sensor for detecting the ribbon tension, and tension adjusting driving mechanisms in both of the ribbon feeding side and ribbon winding-up side. Consequently, the system becomes complicated in construction.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a tension adjusting mechanism which may keep the ribbon tension constant without driving mechanisms.

5 According to the present invention, there is provided a mechanism for adjusting tension of an inked ribbon of a printer having a pair of frames, comprising, a ribbon winding side ribbon holder rotatably supported on the frames, a ribbon supply side ribbon holder rotatably supported on the frames,
10 guide rollers provided for guiding an inked ribbon expanded between the winding side ribbon holder and the supply side ribbon holder, at least one ribbon tension detecting plate rotatably supported on one of the frames and supporting one of the guide rollers so as to be rotated in dependency on
15 tension of the inked ribbon, ribbon tension adjusting means responsive to angular position of the ribbon tension detecting plate for applying a load on the corresponding ribbon holder so that the tension of the inked ribbon is adjusted to a predetermined value.

20 The ribbon tension adjusting means comprises a brake drum provided to be rotated together with the corresponding ribbon holder, and a brake belt slidably engaged with the surface of the brake drum, a base end of the brake belt is fixed, and a movable end of the brake belt is connected to
25 the ribbon tension detecting plate so as to be moved by the ribbon tension detecting plate in a brake belt pulling direction.

A spring is connected to the ribbon tension detecting

plate so as to urge the detecting plate in the brake belt pulling direction.

The brake drum is provided to be rotated by a power source of the printer through a power cutting off device.

5 The power cutting off device is a differential.

In an aspect of the present invention, the power cutting off device is a friction clutch.

The differential is composed by a bevel gear device, or a planetary gear device.

10 These and other objects and features of the present invention will become more apparent from the following detailed description with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

15 Fig. 1 is a side view of a thermal printer having a tension adjusting mechanism according to a first embodiment of the present invention;

Fig. 2 is a front view of the thermal printer;

20 Fig. 3 is a sectional view of a brake drum having a differential transmission device;

Fig. 4 is a sectional view of the brake drum taken along a line IV-IV of Fig. 3;

Fig. 5 is a side view of a thermal printer according to a second embodiment of the present invention;

25 Figs. 6a and 6b show another example of a differential composed by a planetary gear device;

Fig. 7 is a perspective view of a thermal printer provided with a tension adjusting mechanism according to the third

embodiment of the present invention;

Fig. 8 is a perspective view of the thermal printer when a printing mechanism portion is opened;

Fig. 9 is a perspective view of the thermal printer when covers are detached from frames;

Figs. 10 and 11 are exploded perspective views showing ribbon tension detecting means;

Fig. 12a is an exploded perspective view of a tension adjusting mechanism;

Fig. 12b is an exploded perspective view of a belt tension plate;

Fig. 13 is a side view of the thermal printer; and

Fig. 14 shows details of a movable plate.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Figs. 1 and 2, in a printing portion 1, a thermal head 21 is mounted by a thermal head supporting device (not shown) and provided to be pressed against a platen 22 to perform thermal printing. A pair of frames 10 and 11 rotatably support a ribbon supply side ribbon holder 13 and a ribbon winding side ribbon holder 13a. A rolled inked ribbon 12 is mounted on the ribbon holder 13. An inked ribbon 12a is drawn out from the rolled inked ribbon 12 in the direction of the arrow A of Fig. 1, and wound up on the ribbon holder 13a through ribbon guide rollers 33, 34, 35 and 36 in printing operation.

On a shaft on which the supply side ribbon holder 13 is securely mounted as will be hereinafter described, a supply side brake drum 14 is securely mounted to be rotated together

with the ribbon holder 13. A brake belt 15 as a ribbon tension adjusting member and having a friction surface on which a friction material such as felt is adhered is wound on the brake drum 14 at the friction surface. An end of the brake
5 belt 15 is secured to the frame 10 through a fixing plate 16. The fixing plate 16 is fixed to the frame 10 by a screw 16b inserted in an elongated hole 16a of the frame 10, so that the position of the fixing plate 16 can be adjusted in the longitudinal direction of the belt 15. The other end
10 of the brake belt 15 is fixed to a fixing plate 23 which is in turn secured to a tension detecting plate 17 through a shaft 18 as shown in Fig. 2.

The tension detecting plate 17 is pivotally mounted on a shaft 19 fixed to the frame 10, and connected to a tension
15 detecting plate 28 pivotally mounted on a shaft 56 fixed to the frame 11. The tension detecting plates 17 and 28 are connected to each other by a connecting plate 27. A shaft 20 is fixed to the frames 10 and 11 and slidably engaged in an arcuated hole 17a formed in each of the tension detecting
20 plates 17 and 28 so as to limit the pivoting range of the tension detecting plates 17 and 28.

A tension spring 24 is provided between a pin 25 mounted on the tension detecting plate 17 and a pin 26 mounted on the frame 10 so as to urge the tension detecting plate 17
25 in the counterclockwise direction about the shaft 19 to pull the brake belt 15. The ribbon guide roller 33 is pivotally supported on the tension detecting plates 17 and 28.

On a shaft on which the ribbon winding side ribbon holder

13a is mounted as described hereinafter, a winding side brake drum 40 is securely mounted so as to be rotated together with the ribbon holder 13a. A brake belt 41 similar to the brake belt 15 is wound on the brake drum 40 at a friction surface thereof. An end of the brake belt 41 is secured to the frame 10 through a fixing plate 43 which is fixed to the frame 10 by a screw inserted in an elongated hole of the frame 10 similarly to the supply side. The other end of the brake belt 41 is fixed to a fixing plate 44 which is in turn secured to a tension detecting plate 45 through a shaft 46.

The tension detecting plate 45 is pivotally mounted on a shaft 47 secured to the frame 10, and connected to another tension detecting plate (not shown) pivotally mounted on the other side frame 11. The tension detecting plate 45 and the other tension detecting plate on the frame 11 are connected by a connecting plate 53. A shaft 48 is fixed to the frames 10 and 11 and slidably engaged in an arcuated hole 49 formed in each of tension detecting plate 45 so as to limit the pivoting range of the tension detecting plate 45.

A tension spring 50 is provided between a pin 52 mounted on the tension detecting plate 45 and a pin 51 mounted on the frame 10 so as to urge the tension detecting plate 45 in the clockwise direction about the pin 47 to pull the brake belt 41. The ribbon guide roller 36 is pivotally supported on the tension detecting plate 45.

It should be noted that the brake drum 40, tension detecting plate 45 and others in the ribbon winding side shown in Fig. 1 are positioned behind those of the ribbon supply

side, and hence these members are not depicted in Fig. 2, and that the rolled ribbon 12 of Fig. 1 is omitted in Fig. 2.

Referring to Figs. 2 and 3, a driving shaft 65 is
5 rotatably supported on the frame 10 and another supporting plate (not shown) for supporting and driving the ribbon winding side ribbon holder 13a. The ribbon holder 13a is detachably supported on a supporting core 67 secured to the shaft 65 by a pin 68 and on another shaft 65a. The ribbon supply side
10 ribbon holder 13 is supported in the same manner as the ribbon holder 13a, although supporting shafts are not shown in Fig. 2.

A pulley 58 is securely mounted on the shaft 65 and connected by a belt 57 to another pulley (not shown) which
15 is connected to a driving source for the platen 22 through a one-way clutch (not shown) so as to transmit driving force to the pulley 58.

Referring to Figs. 3 and 4, the winding side brake drum 40 is rotatably mounted on the shaft 65 and on a flange of
20 the pulley 58. In the brake drum 40, a differential gear device of bevel gears is provided. The differential gear device comprises an input bevel gear 61 rotatably mounted on the shaft 65 and fixed to the pulley 58, a pair of bevel gears 62 and 63 provided in the brake drum 40, and an output
25 bevel gear 64 fixed to the shaft 65 by a pin 66.

In operation, when the inked ribbon 12a is loosened in the ribbon supply side, the tension detecting plate 17 is rotated about the shaft 19 in the direction a of the arrow

B by the spring 24. Therefore, the friction surface of the brake belt 15 is pressed against the brake drum 14, so that the tension applied to the inked ribbon 12a increases.

When the tension of the inked ribbon 12a increases over
5 the tension applied to the guide roller 33 by the tension spring 24, the tension detecting plate 17 is pivoted in the direction b of the arrow B. Consequently, the friction resistance of the brake belt 15 to the brake drum 14 reduces, thereby reducing the tension applied to the inked ribbon 12a.

10 In the ribbon winding side, when the inked ribbon 12a is loosened in the ribbon winding side, the tension detecting plate 45 is rotated about the shaft 47 in the direction a of the arrow C by the spring 50. Therefore, the friction surface of the brake belt 41 is pressed against the brake
15 drum 40 to stop the brake drum 40.

Consequently, the power from the belt 57 is transmitted to the bevel gears 62 and 63 through the pulley 58 and bevel gear 61 to rotate the bevel gear 64 and the shaft 65. Thus, the ribbon holder 13a is rotated to wind up the ribbon 12a,
20 thereby increasing the tension of the ribbon 12a.

When the tension of the inked ribbon 12a increases over the tension applied to the guide roller 36 by the tension spring 50, the tension detecting plate 45 is pivoted in the direction b of the arrow C. Consequently, the friction
25 resistance of the brake belt 41 to the brake drum 40 reduces, thereby releasing the brake drum. Therefore, the rotation of the bevel gear 61 is transmitted to the brake drum 40 through the bevel gears 62 and 64, so that the drum 40 is rotated

together with the bevel gears 62 and 64. The bevel gears 62 and 63 revolve around the bevel gear 64. Consequently, the shaft 65 does not rotate. Hence, the inked ribbon 12a is not wound.

5 Thus, the tension applied to the guide roller 36 by the tension spring 50 is balanced with the tension of the inked ribbon 12a, so that a constant tension can be applied to the inked ribbon in the ribbon winding side.

Fig. 5 shows the second embodiment of the present
10 invention. Two gears 71 and 72 are mounted on the frame 10 by shafts 73 and 74 and meshed with each other. Shafts 75 and 76 are fixed to the gears 71 and 72, respectively. Springs 24 and 50 are provided between shafts 75, 76 and pins 25, 51. Other ends of the shafts 75, 76 are engaged with circular
15 holes 77 and 78, respectively.

When one of the gears 71 and 72 are rotated, the angle and length of each of the springs 24 and 50 are changed at the same time, thereby changing the tension of the ribbon. Each of the shafts 75 and 76 is secured to the adjusted position.

20 Figs. 6a and 6b show another example of a differential composed by a planetary gear device.

The planetary gear device comprises a pair of sun gears 261 rotatably mounted on a shaft 265, two couples of planetary gears 262 and 263.

25 The rotation of a shaft 210 is transmitted to the input side sun gear 261 through gears 220 and 258. When a brake drum 240 is stopped, the rotation is transmitted to the gear 264 through the input side sun gear, planetary gears 262,

263 and output side sun gear.

Fig. 7 is a perspective view of a thermal printer provided with a tension adjusting mechanism according to the third embodiment of the present invention. Fig. 8 is a perspective view of the thermal printer when a printing mechanism portion is opened, and Fig. 9 is a perspective view of the thermal printer when covers are detached from frames.

The thermal printer 101 comprises a platen roller 111, a thermal head holder 112 holding a thermal head, a printing mechanism 102, and a paper detecting sensor 103. The printing mechanism 102 has a winding side ribbon holder 121 and a supply side ribbon holder 122, both of the holders 121 and 122 are supported on bearings 135a to 135d secured to machine frames 133 and 134 in covers 131, 132. On the supply side ribbon holder 122, a rolled inked ribbon 125 is mounted. A power transmitting gear 124 is secured to an end of a shaft of the winding side ribbon holder 121, and a knob 123 for manually rotating the holder 121 is secured to the other end of the shaft in order to tighten the ribbon on the holder.

As shown in Fig. 8, the printing mechanism 102 and the paper detecting sensor 103 can be opened in order to change the rolled ribbon and paper.

Figs. 10 and 11 are exploded perspective views showing ribbon tension detecting means. The ribbon tension detecting means comprises a winding side ribbon tension detecting framework 140 and a supply side ribbon tension detecting framework 150. The winding side ribbon tension detecting framework 140 comprises a pair of arms 140a and 140b, a

connecting plate 145 between the arms 140a and 140b, and a ribbon guide roller 141 fixed to the arms 140a and 140b.

5 A pin 143 of the arm 140a is rotatably engaged with a hole 331 of the frame 133, and a hole 144 of the arm 140b rotatably mounted on a shaft 332 fixed to the frame 134. Thus, the ribbon tension detecting framework 140 is pivotally supported on the frames 133 and 134. A ribbon guide roller 142 passes through elongated holes 147 and 148 of the arms 140a and 140b and is fixed to the frames 133 and 134 at holes
10 333 and 334.

The supply side ribbon tension detecting framework 150 comprises a pair of arms 150a and 150b, a ribbon guide roller 155 and a connecting rod 155a which are fixed to the arms 150a and 150b. Holes 501 and 502 formed in the arms 150a
15 and 150b are rotatably engaged with shafts 152 and 153 securely to the frame 134 and 133, respectively. Thus, the supply side ribbon tension detecting framework 150 is pivotally mounted on the frames 133 and 134. Mounted on the shaft 152 is a coil spring 151 an end of which is engaged with a hole
20 503 of the arm 150a and the other end is engaged with a hole 504 of the frame 134, so that the ribbon tension detecting framework 150 is downwardly urged by the spring 151 so that the arm 150a is pressed against a shaft 154 as described hereinafter.

25 Referring to Fig. 12a showing a tension adjusting mechanism, a gear train comprising gears 612, 613 and 614 are rotatably mounted on a gear supporting plate 610 by a shaft plate 611 so as to transmit the power for the platen

shaft to the tension adjusting mechanism. Each of the gears 612, 613 and 614 are rotatably mounted on a shaft 611a attached to the shaft plate 611. The shaft 611a is inserted in an elongated hole of the gear supporting plate 610 which is
5 secured to the frame 134. A pulling spring 615 is provided between the gear supporting plate 610 and the shaft plate 611, thereby downwardly urging the shaft plate 611. Therefore, even if the gear 612 strikes the teeth of the gear of the platen shaft without meshing therewith, the shaft plate
10 611 is upwardly deflected. Consequently, the gears are prevented from breaking. Shafts 620 and 630 are rotatably supported on double walls 134a and 134b of the frame 134.

On the shaft 620, a gear 621 is securely mounted, and a reverse gear 622 is mounted, interposing a reverse one-way
15 clutch 623.

A friction clutch F is provided on the shaft 630. The friction clutch F comprises a brake drum 634, a spring 635 inserted in the brake drum 634, a pressure plate 636 fixed to the shaft 630 to press the spring 635 axially into the
20 brake drum 634, a friction plate 633 rotatably mounted on the shaft 630, and a free gear 632 rotatably mounted on the shaft 630. The brake drum 634 is attached to the shaft 630 by a pin 640 the end of which is slidably engaged with an axial groove formed on the shaft 630 so that the drum 634
25 can be rotated together with the shaft and axially urged by the spring 635. Thus, the drum 634 pushes the friction plate 633 so that the friction plate is pressed against the side of the gear 632. A gear 631 is mounted on the shaft 630 through